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13. Abstract (Maximum 200 words). <p>During March-May 1993, the SUNY group participated in three cruises to Eckernfoerde Bucht. Multiple box cores (4 to 7) were collected from 14 stations. Many of the stations were reoccupied on successive cruises, as shown in Tables 1-3. This work was coordinated closely with boundary-layer measurements by Don Wright and acoustic observations by Darrell Jackson</p> <p>The box cores were subsampled for sedimentological, radiochemical and biological studies and to obtain multiple x-ray and microfabric slabs. Some of the biological samples were returned to a shore-based laboratory for incubation experiments. Some of the radiochemical samples were returned immediately to the U.S. Most of the samples remained in Germany until the end of the spring and will arrive at SUNY Stony Brook during the second week of August.</p> <p>This report summarizes the field sampling and some initial radiochemical and x-radiographic observations. The bulk of the analyses could not begin until samples were returned to the SUNY laboratories.</p>					
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PROGRESS REPORT TO NAVAL RESEARCH LABORATORY (CBBL SRP)

July 1993

PHYSICAL AND BIOLOGICAL MECHANISMS INFLUENCING THE DEVELOPMENT
AND EVOLUTION OF SEDIMENTARY STRUCTURE

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General Summary of Work During This Period

During March-May 1993, the SUNY group participated in three cruises to Eckernförde Bucht. Multiple box cores (4 to 7) were collected from 14 stations. Many of the stations were reoccupied on successive cruises, as shown in Tables 1-3. This work was coordinated closely with boundary-layer measurements by Don Wright and acoustic observations by Darrell Jackson.

The box cores were subsampled for sedimentological, radiochemical and biological studies and to obtain multiple x-ray and microfabric slabs. Some of the biological samples were returned to a shore-based laboratory for incubation experiments. Some of the radiochemical samples were returned immediately to the US. Most of the samples remained in Germany until the end of the spring and will arrive at SUNY Stony Brook during the second week of August.

This report summarizes the field sampling and some initial radiochemical and x-radiographic observations. The bulk of the analyses could not begin until samples were returned to the SUNY laboratories.

Description of Coring Stations

Most of the cores were collected at locations where the APL tower and the VIMS tetrapod were deployed, as shown below.

	Cruise Number		
	<u>BS-1</u>	<u>BS-2</u>	<u>BS-3</u>
APL/VIMS deployment site March-April	stations A,B,C,D,E,F	stations D,F	station D
APL/VIMS deployment site April-May	none	stations N,O,P	stations N,O

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In addition, two locations were established at the eastern end of Eckernförde Bucht near Mittelgrund, and a location was established at the western end near the navy base. These three sites provided substrates contrasting with the tower/tetrapod deployment sites.

Preliminary field descriptions at the tower/tetrapod sites indicated about one cm of soft brown (10 YR 5/4) mud overlying black (N2-N3) mud. The brown mud was characterized by a dense mat of worm tubes (probably spionid polychaetes) and occasional pectinerid polychaetes. The entire sediment column was pelletized. Shells of bivalves were found throughout the cores, with occasional live specimens. Much of the sand fraction appeared to be shell fragments.

The two locations near Mittelgrund contained glacial sand and pebbles, and had a more diverse benthic community. The location at the west end of Eckernförde had a large contribution of terrigenous debris (sand, twigs, leaves, eel grass).

Sedimentological and Radiochemical Sampling

The radiochemical and sedimentological 6" subsample cores (RS/C samples in Tables 1-3) were extruded and dissected at 1 cm intervals to 15 cm depth in cores. Below 15 cm, sediment from alternate centimeters was saved. During cruises BS-2 and BS-3, entire box cores (20 cm x 30 cm) were extruded at 0.5-cm intervals to 15 cm depth in cores (identified as Th-234 samples in Tables 2 and 3).

The sediment will be divided and examined for both radiochemical and sedimentological properties. Some samples have been dried to calculate porosity, and Th-234 has been measured directly by γ -detection techniques. A preliminary profile is shown in Fig. 1. The apparent limitation of excess Th-234 to the upper centimeter is the reason we changed our sampling scheme to 0.5-cm intervals. Excess Pb-210 also was measured in these samples by γ -detection (Fig. 1). Additional Pb-210 analyses will be done by α -detection techniques. Grain size will be examined by a combination of Sedigraph and settling-column techniques.

Sediment slabs were collected in plexiglas trays (3 cm x 12 cm cross section) for radiographic examination of sedimentary structures. Vertical slabs were obtained with contrasting orientation, and horizontal slabs were obtained at several depths in core. Some of these same slabs will be dissected to examine microfabric. Fig. 2 presents an x-ray positive from the tower/tetrapod site during cruise BS-2. The sedimentary structure reveals physical stratification, with little destruction by mottling. The effects of bioturbation are most obvious in the Mittelgrund cores and least obvious at the west end of Eckernförde (near the navy base).

Benthic Biological Sampling

The benthos subsample cores (BIO in Tables 1-3) were divided into 0-2 and 2-10 cm layers, and sieved through a 500 μ m sieve. Animals collected on the sieve were then preserved in

glass jars with 4% seawater formaldehyde and rose bengal. Animals will be counted and identified to the lowest taxonomic unit.

A bioturbation experiment was established to compare vertical and horizontal particle bioturbation rates in a variety of sediments and faunal communities. Six-inch cores were brought to shore and placed in a running seawater system. Cores were drained and vertical plugs of fluorescent marker and mud were added to the center of each core to trace the horizontal component of bioturbation. Then cores were refilled with water and a 50 ml suspension of a second color of fluorescent particles (in seawater) was added to each core. These particles settled overnight onto the sediment surface.

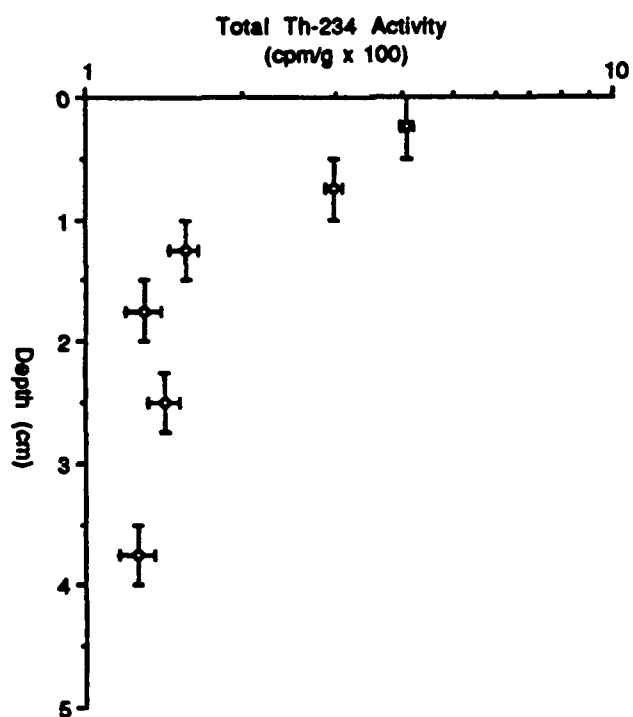
Control cores were broken down during the following two days. There was one control core from each station. Nine to 12 subcores (small syringes) were taken from each control core. Each subcore was vertically sectioned at 7 depth intervals of 0-0.5, 0.5-1, 1-1.5, 1.5-2, 2-3, 3-4, and 4-5 cm. Cores for porosity also were taken and divided in the same manner. Small x-ray slabs were obtained from each core.

Salinity and temperature were monitored during the course of the experiment. Experimental cores were incubated in the running seawater system for approximately 2 weeks, then were broken down in the same manner as the controls. After subcores were taken from the experimental cores, the remaining sediment (~70% of the total) was sieved through a 500- μ m sieve, and the animals collected were preserved for later enumeration. Fluorescence from sediment subsamples will be extracted and measured by fluorometry.

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BS-2 Core 118-Tower/Tetrapod Site



BS-2 Core 118-Tower/Tetrapod Site

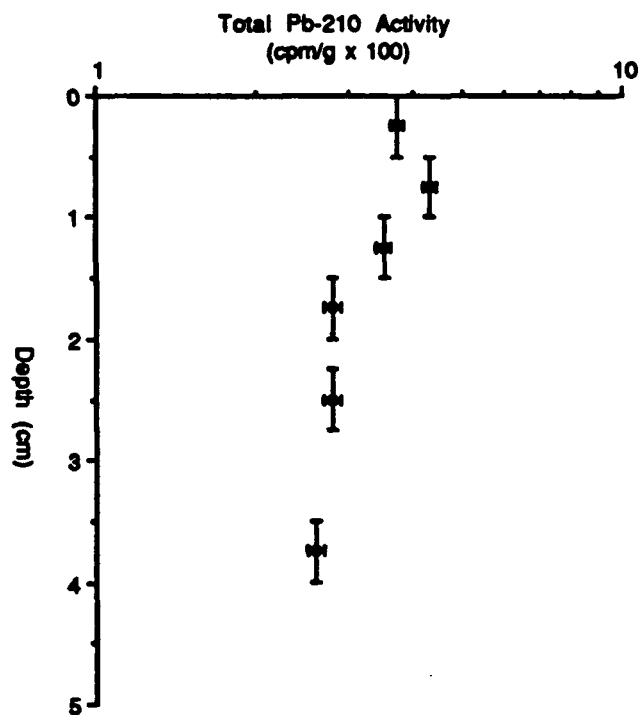


Fig. 1. - Preliminary profiles of total Th-234 and Pb-210. Supported levels must be measured and the system must be calibrated before excess activities can be calculated.

These profiles suggest that excess Th-234 is limited to about 1 cm depth in cores, and that excess Pb-210 extends below 4 cm.

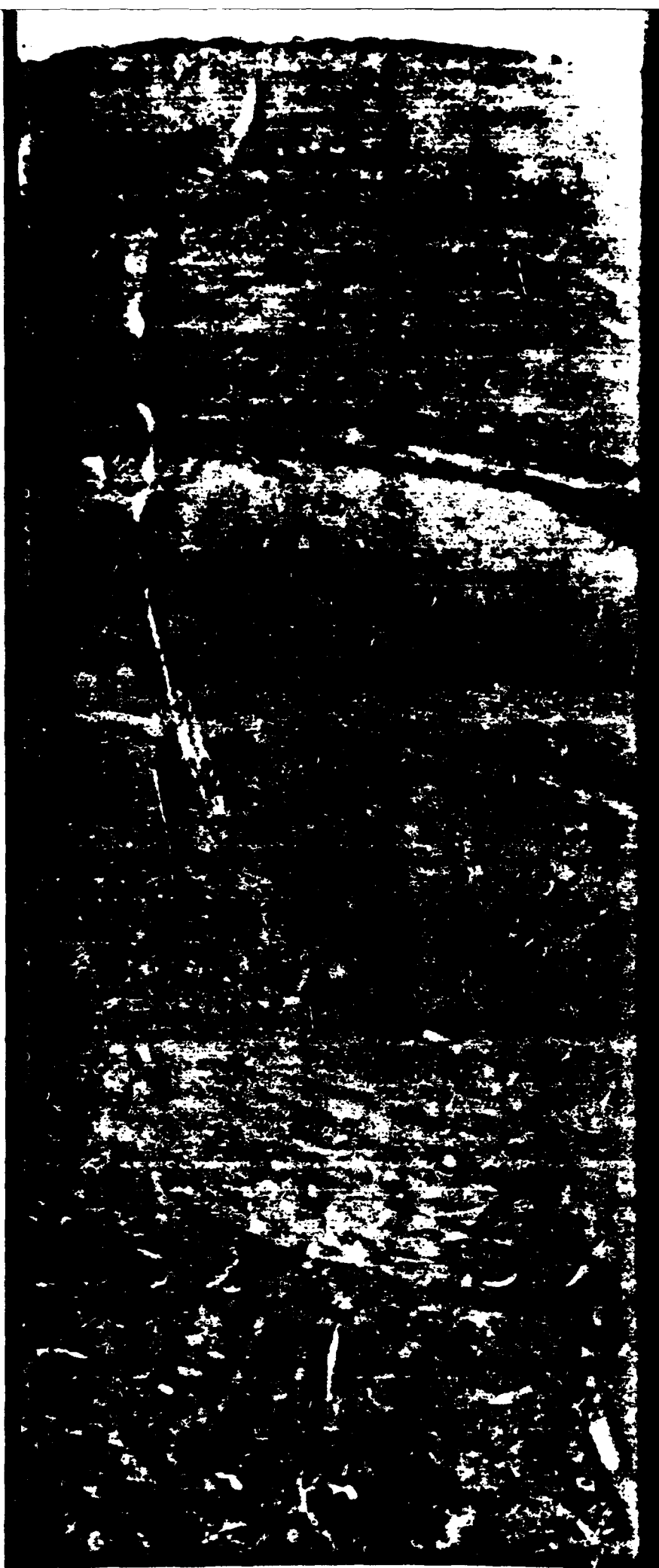


Fig. 2. - X-ray positive from tower/tetrapod station D (119). This is the true scale.

Physical stratification is clear, with little destruction by bioturbation. Disruption by gas is evident below 20 cm.

These slabs are being dissected to examine microfabric.

Table 1. - List of samples collected in Eckernförde Bucht during Cruise BS-1 on R/V PLANET

STATION SUNY/FWG	DATE	TIME	LAT.	LONG.	DEPTH (M)	SAMPLES	NOTE
56/A-2	3/29/93	15:00	54 29.410	9 58.867	26.0	(1)R/SC, (3)BIO	TOWER SITE
57/A-3		15:19	54 29.416	9 58.860		(3)BIO, (1)ARC	
58/A-4		15:40	54 29.410	9 58.871		(3)BIO, (2)VX-R	
59/A-5		15:57	54 29.412	9 58.875		(1)R/SC, (1)VX-R, (3)HX-R	
60/B-1	3/29/93	16:24	54 29.396	9 59.145	25.5	(1)R/SC, (3)BIO	TOWER SITE
61/B-2		16:55	54 29.396	9 59.152		(3)BIO, (2)VX-R	
62/B-3		17:30	54 29.396	9 59.166		(3)BIO, (1)ARC	
63/B-4		17:40	54 29.388	9 59.138		(1)R/SC, (1)VX-R, (3)HX-R	
64/C-1	3/30/93	8:35	54 29.508	9 58.988	26.0	(1)R/SC, (3)BIO	TOWER SITE
65/C-2		9:00	54 29.489	9 58.995		(3)BIO, (2)VX-R	
66/C-3		9:21	54 29.485	9 58.992		(3)BIO, (1)ARC	
67/C-4		9:40	54 29.488	9 58.996		(1)R/SC, (1)VX-R, (3)HX-R	
DIVER/T	3/30/93	11:00	54 29.247	9 58.592	26.0	(1)R/SC, (2)BIO	S.W. OF TOWER SITE
69/G-1	3/30/93	18:16	54 30.038	10 01.905	22.0	(3)BIO, (1)VX-R	W. SIDE OF MITTELGRUND
70/G-2		18:37	54 30.056	10 01.919		(3)BIO, (1)VX-R, (2)HX-R	
71/G-3		18:44	54 30.051	10 01.912		(3)BIO, (1)ARC	
72/G-4		19:14	54 30.045	10 01.885		(1)R/SC, (1)VX-R,	
73/H-1	3/31/93	8:23	54 28.137	9 52.310	21.0	(1)R/SC, (3)BIO	ECKERNFÖRDE NAVY BASE
74/H-2		8:44	54 28.163	9 52.276		(3)BIO, (2)VX-R	
75/H-3		8:55	54 28.136	9 52.289		(3)BIO, (1)ARC	
76/H-4		9:07	54 28.136	9 52.296		(1)R/SC, (1)VX-R, (3)HX-R	
77/D-1	3/31/93	9:56	54 29.518	9 58.943	26.0	(1)R/SC, (3)BIO	TOWER SITE
78/D-2		10:08	54 29.531	9 58.921		(3)BIO, (2)VX-R	
79/D-3		10:18	54 29.528	9 58.932		(3)BIO, (1)ARC	
80/D-4		10:28	54 29.530	9 58.908		(1)R/SC, (1)VX-R, (3)HX-R	

Table 1. - Continued

STATION SUNY/FWG	DATE	TIME	LAT.	LONG.	DEPTH (M)	SAMPLES	NOTE
81/E-1	3/31/93	10:42	54 29.451	9 59.122	26.0	(1)R/SC, (3)BIO	TOWER SITE
82/E-2		10:50	54 29.472	9 59.098		(3)BIO, (2)VX-R	
83/E-4		11:00	54 29.498	9 59.127		(3)BIO, (1)ARC	
84/E-5		11:10	54 29.498	9 59.128		(1)R/SC, (1)VX-R, (3)HX-R	
85/F-1	3/31/93	11:21	54 29.378	9 58.975	26.0	(1)R/SC, (3)BIO	TOWER SITE
86/F-2		11:34	54 29.414	9 59.028		(3)BIO, (2)VX-R	
87/F-3		11:44	54 29.427	9 59.043		(3)BIO, (1)ARC	
88/F-4		11:54	54 29.426	9 59.021		(1)R/SC, (1)VX-R, (3)HX-R	
89/I-1	4/1/93	8:24	54 30.010	10 01.893	24.0	(1)R/SC, (3)BIO	MITTELGRUND
90/I-2		8:32	54 30.001	10 01.935		(3)BIO, (2)VX-R	SAND/MUD
91/I-3		8:48	54 30.016	10 01.936		(3)BIO, (1)ARC	BOUNDARY
92/I-4		8:59	54 30.014	10 01.951		(1)R/SC, (1)VX-R, (3)HX-R	
93/K	4/1/93	9:26	54 29.298	9 58.991	26.0	(1)R/SC	BOX CORE/DIVER CORE COMPARISON
94/L	4/1/93	9:46	54 29.506	9 58.991	26.5	KC	
95/M	4/1/93	10:17	54 30.016	9 58.787	28.0	KC	POCK MARK

KEY: R/SC - 6" RADIOCHEMISTRY/SEDIMENTOLOGY CORE

BIO - 3" BIOLOGY CORE

ARC - 3" ARCHIVE CORE

VX-R - VERTICAL X-RAY TRAY (SAMPLED NORMAL TO SEABED)

HX-R - HORIZONTAL X-RAY TRAY (SAMPLED PARALLEL TO SEABED)

BE - 6" BIOTURBATION EXPERIMENT CORE

SC - 10cc SYRINGE CORE

Th-234 - 20x30cm BOX EXTRUDED FOR Th-234 CHEMISTRY

KC - KASTEN CORE

Table 2. - List of samples collected in Eckernförde Bucht during Cruise BS-2 on R/V HELMSAND

STATION SUNY/FWG	DATE	TIME	LAT.	LONG.	DEPTH (M)	SAMPLES	NOTE
101/I	4/27/93	13:15	54 30 00.8	10 01 59.4	24.0	(1)R/SC, (3)BIO	REOCCUPATION
102/I		13:30	54 30 00.8	10 01 59.4		(3)BIO, (1)ARC	
103/I		13:44	54 30 00.8	10 01 59.4		(3)BIO, (2)VX-R	
104/I		13:56	54 30 00.8	10 01 59.9		(1)R/SC, (1)VX-R, (3)HX-R	
105/I		14:10	54 30 00.7	10 01 59.4		Th-234	
106/I		14:20	54 30 00.6	10 02 00.0		(2)BE, (3)SC	
107/I		14:30	54 30 00.8	10 01 58.6		(2)BE, (3)SC	
110/H	4/28/93	8:45	54 28 00.2	9 52 11.2	24.0	(1)R/SC, (3)BIO	REOCCUPATION
111/H		9:00	54 28 00.1	9 52 10.8		(3)BIO, (1)ARC	
112/H		9:13	54 28 00.1	9 52 11.2		(1)R/SC, (1)VX-R, (2)HX-R	
113/H		9:22	54 28 00.1	9 52 11.0		Th-234	
114/H		9:45	54 28 01.2	9 52 10.5		(4)BE, (3)BIO, (2)VX-R, (3)SC	50x50CM BOX
115/D	4/28/93	10:45	54 29 31.8	9 58 53.9	24.0	(1)R/SC, (3)BIO	REOCCUPATION
116/D		11:11	54 23 31.6	9 58 53.6		(3)BIO, (1)ARC	
117/D		11:20	54 23 31.2	9 58 53.5		(1)R/SC, (1)VX-R, (2)HX-R	
118/D		11:42	54 29 31.0	9 58 54.3		Th-234	
119/D		12:00	54 29 30.9	9 58 54.4		(4)BE, (3)BIO, (2)VX-R, (3)SC	50x50CM BOX
124/N	4/29/93	16:00	54 29 44.3	9 59 29.6	24.0	(1)R/SC, (3)BIO	NEW TOWER
125/N		16:15	54 29 44.9	9 59 28.2		(3)BIO, (1)ARC	
126/N		16:30	54 29 45.0	9 59 28.6		(1)R/SC, (1)VX-R, (2)HX-R	
127/N		16:43	54 29 44.8	9 59 27.8		Th-234	
128/N		17:00	54 29 45.0	9 59 28.7		(4)BE, (3)BIO, (2)VX-R, (3)SC	50x50CM BOX
139/O	4/29/93	9:58	54 29 36.4	9 59 19.4	?	(1)R/SC, (3)BIO	NEW TOWER
140/O		10:07	54 29 36.5	9 59 19.3		(3)BIO, (1)ARC	
141/O		10:19	54 29 36.5	9 59 18.9		(1)R/SC, (1)VX-R,	
142/O		10:45	54 29 36.7	9 59 19.7		Th-234	
143/O		11:01	54 29 36.7	9 59 19.2		(3)BE, (3)BIO, (1)VX-R,	

Table 2. - Continued

STATION SUNY/FWG	DATE	TIME	LAT.	LONG.	DEPTH (M)	SAMPLES	NOTE
145/G	4/29/93	12:41	54 30 03.9	10 01 54.2	20.0	(3)BIO, (1)VX-R	MITTELGRUND
146/G		13:32	54 30 04.4	10 01 54.0		(2)BE, (3)SC	
147/G		13:52	54 30 04.4	10 01 54.3		(1)BE, (1)R/SC	
148/F	4/29/93	14:47	54 29 28.9	9 58 49.4	?	(1)R/SC, (3)BIO	REOCCUPATION
149/F		14:58	54 29 28.9	9 58 49.8		(3)BIO, (1)ARC	
150/F		15:08	54 29 28.8	9 58 48.9		(1)R/SC, (1)VX-R,	50x50CM BOX
151/F		15:25	54 29 28.8	9 58 43.4		(4)BE, (3)BC, (1)VX-R, (3)SC	
152/P	4/30/93	9:20	54 29 37.4	9 59 37.5	?	(1)R/SC, (3)BIO	NEW TOWER
153/P		9:39	54 29 37.4	9 59 38.4		(3)BIO, (1)VX-R	
154/P		9:42	54 29 37.4	9 59 37.4		(3)BIO, (1)ARC	
155/P		10:02	54 29 37.3	9 59 37.4		(1)R/SC, (1)VX-R	

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Table 3. - Continued

STATION SUNY/FWG	DATE	TIME	LAT.	LONG.	DEPTH (M)	SAMPLES	NOTE
259/H	5/26/93	15:35	54 27 58.2	9 52 06.7	?	(1)R/SC, (3)BIO	REOCCUPATION
261/H		15:59	54 27 57.6	9 52 13.6		(3)BIO, (2)VX-R	(NAVY BASE)
262/H		16:08	54 27 59.4	9 52 11.0		Th-234	
263/H		16:15	54 28 01.6	9 52 11.6		(1)R/SC, (1)VX-R, (2)HX-R	
268/G	5/27/93	14:02	54 30 2.25	10 01 42.1	?	(3)BIO, (2)VX-R	REOCCUPATION
269/G		14:14	54 30 3.10	10 01 40.9		(1)R/SC, (3)BIO	(MITTELGRUND)
270/G		14:21	54 30 2.61	10 01 40.6		(3)BIO, (1)ARC, (1)VX-R	
271/G		14:32	54 30 3.18	10 01 40.7		Th-234	

KEY: RSC - 6" RADIOCHEMISTRY/SEDIMENTOLOGY CORE

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